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10/582,439	06/09/2006	Qingmao Hu	7482P003	4870

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EXAMINER	
CONWAY, THOMAS A	

ART UNIT	PAPER NUMBER
4182	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/582,439	HU ET AL.	
	Examiner	Art Unit	
	THOMAS A. CONWAY	4182	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6/9/2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *6/9/2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/6/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

It would be of great assistance to the Office if all incoming papers pertaining to a filed application carried the following items:

1. Application number (checked for accuracy, including series code and serial no.).
2. Group art unit number (copied from most recent Office communication).
3. Filing date.
4. Name of the examiner who prepared the most recent Office action.
5. Title of invention.
6. Confirmation number (See MPEP § 503).

Drawings

1. The drawings are objected to because box 4 of Fig. 1 contains indefinite language: "e.g.". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date

of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because it does not support the recited language of claims 9, 11 and 19.

Regarding claims 9 and 19, the language of each which are similar, claim 9 recites, "and then modifying the classification of one or more of the pixels by considering spatial relationships between the locations of the classified pixels". The way the claim reads, it seems as if there is an initial classification, selection of threshold, binarization and **then, another** reclassification based on the spatial relationships between pixels. There is no support for this in the specification.

Regarding claim 11, which recites, "at least one data input device for a user to select a region of interest in the image". Although the specification mentions a computer system, there is not explicit mention of an input device for the purposes of selecting a region of interest.

Correction is required. See MPEP § 608.01(b).

Claim Objections

3. Claim18 is objected to because of the following informalities: recites "maximnise", examiner is assuming this is a misspelling of the word "maximise". Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. **Claims 1-4 and 9** are rejected under 35 U.S.C. 102(e) as being anticipated by Farrokhnia et al. (US 6,694,047 B1), hereafter referred to as "Farrokhnia".

Regarding claim 1, Farrokhnia discloses a method of binarising an image composed of pixels having respective intensity values, the method comprising: (i) using prior knowledge about the image to derive a region of interest within it (Col. 8,

lines 24-32);

(ii) using prior knowledge about the image to derive an intensity range of pixels in the said region of interest (Col. 8, lines 44-50);

(iii) obtaining a frequency distribution of the intensities within the said intensity range of pixels within the said region of interest (Col. 8, lines 51-60);

(iv) using the said frequency distribution to derive an intensity threshold (Col., lines 22-23); and

(v) binarising the image by classifying pixels in the said region of interest according to whether their intensities are above or below the said intensity threshold (Col. 9, lines 38-49).

Regarding claim 2, Farrokhnia discloses a method in which the threshold is found by deriving a valley in the frequency distribution within the range, and selecting the intensity threshold to correspond to the valley (Col. 9, lines 30-31).

Regarding claim 3, Farrokhnia discloses a method in which the valley is found by determining the total intensities in a number of intervals defined in the range (Col. 8, lines 53-57; See also Fig. 5), and selecting the intensity threshold as an intensity within the interval having the lowest total intensity (570 in Fig. 5).

Regarding claim 4, Farrokhnia discloses a method in which the intensity threshold is selected as the mid-point of the interval having the lowest total intensity (Col. 9, lines 30-31).

Regarding claim 9, Farrokhnia discloses a method of processing an image which includes binarising it by a thresholding method according to claim 1, and then modifying the classification of one or more of the pixels by considering spatial relationships between the locations of the classified pixels (Col. 9, lines 50-65).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. **Claims 10-14 and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia, in view of Uppaluri et al. (US 6,466,687 B1: “Uppaluri ").

Regarding claim 10 and 11, while Farrokhnia discloses a processor arranged to obtain a frequency distribution of the intensities within the intensity range of pixels within the region of interest, use the frequency distribution to derive an intensity threshold; and binarise the image by classifying pixels in the region of interest according to whether their intensities are above or below the threshold (Col. 3, lines 1-4, See also Claim 1 as detailed previously in this office action), Farrokhnia fails to disclose a computer program product comprising a recording medium and programming instructions stored on the recording medium and readable by a computer system to cause the computer system to perform a method according to claim 1 and at least one data input device for a user to select a region of interest in the image and specify a frequency range within the frequency distribution of the intensities of pixels in the region of interest.

Uppaluri discloses a computer program product (Fig. 13) and a data input device (1340, in Fig. 13) for a user to select a region of interest in the image (Col. 4, lines 45-55) and specify a frequency range within the frequency distribution of the intensities of pixels in the region of interest (Col. 6, lines 34-42).

Farrokhnia’s disclosure did not mention manual inputting of information needed

by his methods to process the image, select a region of interest or specifying a frequency range related to pixels in the region of interest, even though there is mention of importation of the image to be processed. Farrokhnia's methods seem wholly automated, while Uppaluri makes mention that segmentation can be done automatically **or** manually (Col. 4, lines 45-47).

Since Uppaluri's disclosure accommodates both a manual as well as automated setting, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include in Farrokhnia's method, a computer program product to implement the segmentation task as well as an input device to perform the related actions needed to perform segmentation using a' priori knowledge in an efficient manner.

Regarding claim 12, Farrokhnia discloses a processor (Col. 3, lines 1-4) arranged to derive a threshold found by deriving a valley in the frequency distribution within the range, and selecting the intensity threshold to correspond to the valley (Col. 9, lines 30-31).

Regarding claim 13, Farrokhnia discloses a processor (Col. 3, lines 1-4) arranged to find a valley by determining the total intensities in a number of intervals defined in the range (Col. 8, lines 53-57; See also Fig. 5), and selecting the intensity threshold as an intensity within the interval having the lowest total intensity (570 in Fig. 5).

Regarding claim 14, Farrokhnia discloses a processor (Col. 3, lines 1-4) arranged to select the intensity threshold as the mid-point of the interval having the lowest total intensity (Col. 9, lines 30-31).

Regarding claim 19, Farrokhnia discloses a processor (Col. 3, lines 1-4) arranged to process the segmented image by modifying the classes to which each pixel is allocated by considering relationships between the locations of the pixels which have been classified (Col. 9, lines 50-65).

9. **Claims 5-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia, in view of Ramesh et al. (Thresholding based on histogram approximation, IEE Proc.-Vis. Image Signal Processing, Vol 142, No. 5, pp 271-279, October 1995), hereafter referred to as “Ramesh”.

Regarding claim 5, Farrokhnia discloses the limitations of claim 1 but fails to disclose the limitations of claim 5.
There are many known methods to find a threshold for a particular distribution of pixel intensities utilizing a histogram and its associated values, the Farrokhnia method does not speak on the actual manipulation of equations that was used to derive the threshold but makes mention that it is related to the variance (Col. 9, line 36).

Ramesh discloses a method where the threshold is found by minimising a function which is a sum of the variances of the intensities below and above the threshold (Sec. 2.2.2).

Since segmentation using histograms and related thresholds can be done using several methods, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to include in Farrokhnia's method, the steps used in Ramesh's disclosure as one other way to accomplish the same feat of deriving a threshold.

Regarding claim 6, Farrokhnia discloses the limitations of claim 1 but fails to disclose the additional limitation of claim 5 upon which claim 6 is dependent.

There are many known methods to find a threshold for a particular distribution of pixel intensities utilizing a histogram and its associated values, the Farrokhnia method does not speak on the actual manipulation of equations that was used to derive the threshold but makes mention that it is related to the variance (Col. 9, line 36).

Ramesh discloses a method as in claim 5 where the sum of variances is weighted (Sec. 2.2.2). W_1 and W_2 are arbitrary variables representing a weight applied to the sum and could be represented by "A" and "C" (Sec. 2.2.2, pg 274), which are associated with the original a' priori weights of P_1 and P_2 Sec. 2.2.2, pg 274). Weighing by class probability is a common statistical operation.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to include in the method as outlined by Farrokhnia the step of weighting the sum of variances as presented by Ramesh in order to improve the

segmentation process, referred to by Ramesh as the “goodness” of a threshold (Sec. 3, paragraph 1).

10. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia, in view of Ramesh and in further view of N. Otsu (A Threshold Selection Method from Gray-Level Histograms, IEEE Transactions on Systems, Man, and Cybernetics, Vol SMC-9, No. 1, pp 62-66, January 1979), hereafter referred to as Otsu.

Farrokhnia and Ramesh discloses the limitations of claim 6 upon which 7 is dependent but fails to disclose representing labeling the possible values of pixel intensity by an integer index i and their respective frequencies by h(i), and writing the lower and upper intensities respectively as r.sub.low and r.sub.high and their associated equations as recited in claim 7. The use of "i", "h(i)" and “r.sub.low”, “r.sub.high” are arbitrary notations representing the pixel intensity index, their respective frequencies and placeholder for low and high intensities and could just as well be labeled "x" and "g(x)" or any other values.

Otsu discloses a pixel intensity index “i” (“I”, Page 63, paragraph 2) as well as “h(i)” ("ni", Page 63, paragraph 2), as well as “r.sub.low” (“1”, Page 63, paragraph 2) and “r.sub.high” (“L”, Page 63, paragraph 2). Other associated terms can also be found in Otsu’s teachings: weighted sum (weighted by class probabilities, See EQ 14), class probabilities (See EQs 2 and 3), “D(c1)” and “D(c2)” (See EQ 13), and mean values (See EQs 7 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made, to include in the method as outlined by Farrokhnia, supplemented by the teachings of Ramesh, the methods and notations as used by Otsu in order to maximize seperability of resultant class of pixels (Abstract) which would make the segmentation more efficient.

11. **Claims 15-16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia, in view of Uppaluri and in further view of Ramesh.

Regarding claims 15-16 Farrokhnia and Uppaluri disclose the limitations of claim 14 but does not teach a selecting the threshold by minimising a function which is a sum of the variances of the intensities below and above the threshold, the sum or which is a weighted sum based on two constants W.sub.1 and W.sub.2.

Ramesh discloses a method where the threshold is found by minimising a function which is a sum of the variances of the intensities below and above the threshold (Sec. 2.2.2). Ramesh also discloses a method as in claim 5 where the sum of variances is weighted (Sec. 2.2.2). W_1 and W_2 are arbitrary variables representing a weight applied to the sum and could be represented by “A” and “C” (Sec. 2.2.2, pg 274), which are associated with the original a’ priori weights of P_1 and P_2 Sec. 2.2.2, pg 274). Weighing by class probability is a common statistical operation.

Since segmentation using histograms and related thresholds can be done using several methods, it would have been obvious to one of ordinary skill in the art at the

time the invention was made, to include in Farrokhnia and Uppaluri's method, the steps used in Ramesh's disclosure as one other way to accomplish the same feat of deriving a threshold as well as including the step of weighting the sum of variances as presented by Ramesh in order to improve the segmentation process, referred to by Ramesh as the "goodness" of a threshold (Sec. 3, paragraph 1).

12. **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia, in view of Uppaluri, in view of Ramesh and in further view of Otsu.

Farrokhnia, Uppaluri and Ramesh teach the limitations of claim 16 upon which claim 17 is dependent, but fails to teach labeling the possible values of pixel intensity by an integer index i and their respective frequencies by h(i), and writing the lower and upper intensities respectively as r.sub.low and r.sub.high and their associated equations as recited in claim 7. The use of "i", "h(i)" and "r.sub.low", "r.sub.high" are arbitrary notations representing the pixel intensity index, their respective frequencies and placeholder for low and high intensities and could just as well be labeled "x" and "g(x)" or any other values.

Otsu discloses a pixel intensity index "i" ("I", Page 63, paragraph 2) as well as "h(i)" ("ni", Page 63, paragraph 2), as well as "r.sub.low" ("1", Page 63, paragraph 2) and "r.sub.high" ("L", Page 63, paragraph 2). Other associated terms can also be found in Otsu's teachings: weighted sum (weighted by class probabilities, See EQ 14), class probabilities (See EQs 2 and 3), "D(c1)" and "D(c2)" (See EQ 13), and mean values

(See EQs 7 and 8).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to include in the system as outlined by Farrokhnia and Uppaluri, supplemented by the teachings of Ramesh, the methods and notations as used by Otsu in order to maximize seperability of resultant class of pixels (Abstract) which would make the segmentation more efficient.

13. **Claim 8** is rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia, in view of Cheng et al. (Threshold Selection Based on Fuzzy c-Partition Entropy Approach, Pattern Recognition, Vol. 31, No. 7, pp 857-870, 1998), hereafter referred to as “Cheng”.

Farrokhnia discloses the limitations of claim 1 upon which claim 8 is dependent but fails to teach the limitations of claim 8.

Cheng discloses selecting the threshold as a function of parameters which maximise an entropy function which indicates the entropy of a fuzzy partition of the pixels into classes based on the parameters (Sec. 5.1).

As mentioned previously in the analysis of claim 5, there are many methods of segmenting using thresholding and selecting a threshold based on a fuzzy c-partition was among the methods at the time of the invention. Fuzzy c-partitioning is an effective method to select thresholds in an automatic environment (Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the

time the invention was made, to include in the method as outlined by Farrokhnia, the methods as presented by Cheng in order to efficiently select segmenting thresholds in an automated environment as Farrokhnia discloses.

14. **Claim 18** is rejected under 35 U.S.C. 103(a) as being unpatentable over Farrokhnia and Uppaluri, in view of Cheng.

Farrokhnia and Uppaluri disclose the limitations of claim 11 upon which claim 18 is dependent but fails to teach the limitations of claim 18.

Cheng discloses selecting the threshold as a function of parameters which maximise an entropy function which indicates the entropy of a fuzzy partition of the pixels into classes based on the parameters (Sec. 5.1).

As mentioned previously in the analysis of claim 5, there are many methods of segmenting using thresholding and selecting a threshold based on a fuzzy c-partition was among the methods at the time of the invention. Fuzzy c-partitioning is an effective method to select thresholds in an automatic environment (Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to include in the system as outlined by Farrokhnia and Uppaluri, the methods as presented by Cheng in order to efficiently select segmenting thresholds in an automated environment as Farrokhnia discloses.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Erdogan et al. (US 6,567,771 B2) discloses weighing constants applied to variances to better separate confusable class pairs.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS A. CONWAY whose telephone number is (571)270-5851. The examiner can normally be reached on Monday through Friday 8AM - 5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benny Tieu can be reached on 571-272-7490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http:llpair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-21 7-91 97 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the

automated information system, call 800-786-91 99 (IN USA OR CANADA) or 571 -

272-1 000.

/Thomas A. Conway/
Examiner, Art Unit 4182

/Benny Q Tieu/
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